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AMERICAN POTATO JOURNAL

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EAST LANSING, MICHIGAN

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Shipment Restriction As a Means of Meeting Surplus Situation[1]

E. A. STOKDYK, University of California, Berkeley

The word surplus is synonymous with excess. It is a simple word easily spelled and pronounced. However, it is not as readily comprehended.

We hear of many kinds of surpluses—exportable surpluses, regional surpluses, carryover surpluses, operative surpluses, and economic surpluses (2).

Each kind of surplus is claiming the attention of those engaged in the marketing of agricultural products. Each has its peculiar problems. However, we will confine our discussion here to economic surpluses.

What is meant by this term? Changing it to "economic excesses" is of little aid. Translating excess to "superabundance" still leaves us in the woods.

The difficulty is that we must have some base point from which to measure the excess, superabundance or surplus.

Some hold that we do not have an economic surplus unless production is subsequently curtailed. Their base point is the average production over a period of years or the trend of production during some period of time. They imply a "normal price" idea. To judge whether or not there is a surplus at the moment one must wait to see if production is increased or decreased. If production decreases there was a surplus.

[1]Paper read at the Annual Meeting of the Potato Association of America, New Orleans, Louisiana, December, 1931.

[2]For meanings of these terms see Stokdyk, E. A., and Charles H. West. The Farm Board, pp. 56-70. Macmillan, 1930.

This is a longtime point of view and a social point of view. During the time that one is waiting to see whether or not production increases or decreases a host of changes may take place such as the bankruptcy of those originally engaged in producing the crop, the deflation of land values, a marked improvement in technique with a lowering of the cost of production or a decline in the rate of wages.

These factors might result in a new group undertaking production on land less highly valued and at lower costs. Production might remain stationary or even increase. Yet judged by the foregoing definition there would not have been an economic surplus. From a social point of view probably there wasn't. Moreover, society will shed few tears over the situation.

Potato growers need not wait several years, however, to determine whether there is a surplus at the moment. Market prices tell them right now. From their point of view there is an economic surplus whenever prices are so low that they are unremunerative.

For those growers who are exceptionally high cost producer's prices have always been too low and for them there has always been an economic surplus. For some growers, prices were high enough in some years as to be remunerative while in other years prices were too low. Again, prices every year have probably been remunerative to a few growers who are favorably situated.

A definition, then, of an economic surplus, from a short time individualistic point of view may be: that portion of the crop which prevents the marketing at prices remunerative to most of the growers.

How the surplus came into existence is of little concern when the crop is about to be harvested. The market does not debate whether the surplus was caused by excessive acreage, favorable weather, improvement in technique, the inefficient farmer, production on marginal land or any of the hypotheses set forth as responsible. Likewise, potato growers do not debate whether or not there is a surplus if prices are such as to net only 3 cents per hundred weight after the expenses of sacking and loading are paid.

Too frequently marketing agencies have been blamed for low prices when a surplus was responsible. A great deal of bad feeling and misunderstanding has resulted. Moreover, many marketing schemes have resulted in disappointment because they were not set up to handle a surplus situation. There are problems of assembly and distribution in the marketing

process which need attention and which can be handled successfully by joint effort. But to expect agencies organized to handle these problems to battle with a surplus situation is asking too much.

The successful handling of an economic surplus is dependent upon the limitation of the amount which will be placed upon the market. This may imply the destruction of a portion of the crop or the conversion of a portion into by-products. Most attempts to carry over a portion of the crop from one season to the next or longer have resulted disastrously.

The destruction of a portion of a crop through allowing it to remain unharvested is perhaps the most practicable in the case of potatoes under most circumstances. This brings up the question as to whether or not such a procedure is moral, particularly when some are hungry.

The answer seems to lie in the production process. Nature produces some things unassisted by man; she produces them in such abundance that at the point of production they are valueless and man does not harvest them. For instance, in some of our forests many trees fall and rot. There are, no doubt, numerous persons who would be delighted to have them for their fire places. They are, however, unwilling or unable to pay enough for them to induce anyone to harvest and transport the trees to their homes. We are little concerned with the morality of the wastefulness in nature. Why then should we be so greatly concerned with the morality of allowing a portion of a crop to remain unharvested? Is the situation materially changed because man has cooperated with nature and the two have produced such an abundance that at the point of production the crop is close to valueless? Just because man has spent his efforts in assisting nature to produce should we expect him to expend additional effort to market it without being remunerated? Or can we blame him for attempting to obtain enough for his efforts, even though he restrict the supply, to reward him for his efforts in a manner comparable to the returns received by other members of society?

If we have now come to agreement as to what constitutes an economic surplus and if we have agreed that it is moral to attempt to handle a surplus situation, we may next inquire concerning the possibilities and limitations of dealing with a surplus of potatoes.

If an agricultural crop is produced in a limited area, such as Clingstone peaches or raisins in California, the problem of dealing with a surplus is relatively more simple than if the crop is produced in many areas. Even here it is complex enough when it comes to working out the details of control and

determining whose peaches or raisins should remain unharvested.

However, there may be a possibility of increasing returns to growers in some areas even though the crop is produced in a number of areas by restricting the amount marketed.

An estimate of the possibility of controling a surplus situation and an estimate of the degree to which restriction might be employed is dependent upon an analysis of the factors affecting prices.

Each area which may contemplate surplus control must first know to what extent supplies from its particular area influence prices. It may find that it is such a small factor in the general market that it would make little difference if its entire production remained unharvested. On the other hand, it may find that its production is important enough to be a dominating influence on prices.

For the purpose of illustration we will examine the possibilities of surplus control in the case of mid-season potatoes. The author (3) in a determination of the factors affecting the prices of mid-season potatoes constructed an estimating equation from which the probable price for mid-season potatoes could be forecast. Two factors accounted for most of the price variations from year to year, the one, the size of the United States crop, and the other, the volume of shipments from the mid-season districts. From this estimating equation Table 1 has been constructed. Here it is shown that with a United States crop of 400 million bushels and with shipments totaling 45,000 carloads, a season's average price of $1.10 per hundredweight at Chicago may be expected, while with shipments totaling 25,000 carloads an average price of $1.53 per hundredweight would be obtained.

Table 2 shows that with a United States crop of 450 million bushels and shipments from the mid-season districts totaling 45,000 carloads an average season's price at Chicago of $0.96 per hundredweight would prevail, while with shipments of 25,000 carloads a price of $1.39 might be expected.

The question next arises as to whether it would be advisable to restrict shipments if there are 45,000 carloads produced. If so, how many carloads should be marketed?

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[3]Stokdyk, E. A. Some factors influencing the mid-season potato market. Thesis, University of Wisconsin, May, 1929.

Table 1—Probable Prices for Mid-Season Potatoes and Total Returns Which May Be Expected at Shipping Point by Marketing Varying Quantities from the Mid-Season Districts When the United States Crop is 400 Million Bushels.

Number of carloads shipped from the Mid-Season districts	Average price per hundredweight at Chicago	Average price at shipping point with a $0.60 transportation charge deducted from the Chicago price	Total returns at shipping point from marketing the number of carloads shown in column 1 from the Mid-Season districts
1	2	3	4
25,000	$1.53	$0.93	$6,045,000
30,000	1.43	0.83	6,474,000
35,000	1.32	0.72	6,552,000
40,000	1.21	0.61	6,344,000
45,000	1.10	0.50	5,850,000
50,000	.99	0.39	5,070,000
55,000	.88	0.28	4,004,000
60,000	.77	0.17	2,652,000

Table 2—Probable Prices for Mid-Season Potatoes and Total Returns Which May Be Expected at Shipping Point by Marketing Varying Quantities From the Mid-Season Districts When the United States Crop is 450 Million Bushels.

Number of carloads shipped from the Mid-Season districts	Average price per hundredweight at Chicago.	Average price at shipping point with a $0.60 transportation charge deducted from the Chicago price.	Total returns at shipping point from marketing the number of carloads shown in column 1 from the Mid-Season districts.
25,000	$1.39	$0.79	$5,135,000
30,000	1.28	0.68	5,304,000
35,000	1.17	0.57	5,187,000
40,000	1.07	0.47	4,888,000
45,000	0.96	0.36	4,212,000
50,000	0.85	0.25	3,250,000
55,000	0.74	0.14	2,002,000
60,000	0.63	0.03	468,000

Column 3 of Tables 1 and 2 shows the net price per hundredweight at shipping point after deducting $0.60 per hundred weight for transportation costs. (In some areas the cost of transportation from the point of production to the point of consumption is less and in some cases more. The figure $0.60 is an estimate of the average.)

Column 4 shows the total return at shipping point that might be expected by marketing a varying number of carloads from the mid-season sections. With a United States crop of 400 million bushels a total return at shipping point of $6,552,000 would be obtained by marketing 35,000 carloads. The shipment of 35,000 carloads would yield the maximum returns. The shipment of 30,000 carloads would yield slightly less and the shipment of 40,000 carloads would also yield less.

In case the United States crop were 450 million bushels, the shipment of 30,000 carloads would yield the maximum returns. The shipment of more or less would result in smaller total returns at shipping point.

The point to which restriction of shipments might be carried can be estimated under varying circumstances after an analysis of the factors affecting prices has been made. In this illustration it would be desirable to restrict shipments from the mid-season district to a greater degree if the United States crop were large than if it were small.

It is unlikely that a group of producers facing a surplus situation and organized to limit shipments would actually limit shipments to the point where the highest total returns would be obtained because such a procedure might result in a price per unit which would be considered remunerative to all growers and even to prospective growers, with the result of a marked increase in planting in the following season. The point to which most growers would probably be willing to carry a shipment restriction program would be to the point where a price per unit was received that would cover their principal cash expenses.

Having once determined the number of carloads which it would be advisable to send to market in order to bring returns that would be considered remunerative to most of the growers and assuming that producers are of a mind to restrict shipments, the next problem that arises is how shipments shall be restricted and whose potatoes are to remain unharvested.

This part of the problem is indeed complex. At first glance it seems almost unsurmountable. Yet it has been handled by various groups and will no doubt receive increased attention.

The lemon growers through their cooperative organization have handled it by pooling their crop and converting a part into by-products. The lettuce growers of the Imperial Valley formed a Clearing House Association. Each signed an order with the secretary giving him sole authority to order empty cars from the railroad and the amount each grower could ship was prorated according to his acreage and yield per acre.

The grape growers in California formed a Grape Control Board with the assistance of the Federal Farm Board and collected a fee from each grower to pay for the portion of the crop left unharvested or converted into by-products.

Other methods will no doubt be devised to employ restriction programs to meet surplus situations. These will depend upon the nature of the commodity, the conditions under which they are produced, the area covered, and the markets in which the products are sold.

Whether or not restriction programs will in the long run be effective and whether or not it is a better policy to prevent surpluses before they occur through acreage reduction or less intensive cultivation are other questions. Shipment restriction offers a possibility for meeting a pressing situation and will no doubt be employed by various groups when more producers have a clearer understanding of the relationship between supply and price.

Nine Years Results With Potato Fertilizers*

A. M. MUSSER, Clemson College, South Carolina

South Carolina is one of the important second early potato states, where from 14,000 to 24,000 acres are planted annually for the commercial crop. The fertilizer used varies from one to one and one-half tons per acre, the usual amount being about one ton. This makes the question of the kind and amount of fertilizer used an important one. Although the potato has been an important crop for many years very little experimental work relating to fertilizers or other problems has been done with it in South Carolina or other southern states.

Review of Literature

Johnson (1) in Virginia, on a sassafras loam at Norfolk and on a sandy loam of uniform texture at Tasley, in a one year test (1916) found that 8% of phosphoric acid at Tasley and 6% at Norfolk gave larger percentage increases than smaller amounts. He also found that 7% ammonia and 5% potash gave the largest percentage increases at both places and stated that an excess of potash seemed to retard development. Johnson

*Technical Contribution No. 17 from the South Carolina Agricultural Experiment Station, Clemson College, S. C.

harvested these potatoes at three different times, (1) June 14, (2) June 22, and (3) July 3. The percentages above apply to the third harvest when the potatoes were at the same stage of maturity as those in this report.

Floyd and Ruprecht (2) have reported on a three year experiment, 1918-20, conducted in the Hastings, Fla., district. The soil was a virgin sandy loam underlain at a depth of one to three feet with a rather heavy sandy clay sub-soil and very poor in fertility. These workers found acid phosphate to be a better source of phosphoric acid than either pebble or soft phosphate. Five per cent of potash produced 2.2 barrels more per acre than 3%, 3% produced 4 barrels more per acre than 1%, and 1% 12.8 barrels more per acre than no potash. The differences between 5% and 3% and between 3% and 1% were not very great and may or may not have been significant.

The Georgia Coastal Plain Experiment Station (3) at Tifton, Ga., on a Tifton sandy loam soil, reported a six year test where varying amounts of a 4-8-4 (NPK) mixture was used. The results showed that an 800 lb. application gave yields of one bushel per acre greater than 1000 lbs. and only 3 bushels less per acre than 1200 lbs. Their yields were extremely low being 31 bushels (total yield) per acre for a 200 lb. application and increasing in yield as the amount of fertilizer increased to a 56 bushel yield for a 1200 lb. application. The percentages of the No. 1's and 2's together ran in the same order as the yields.

Ware (4) in Mississippi, in a two year test, using 1000 lbs. of a 4-10-4 as a basis, compared N, P and K alone and in various combinations. He found no increase from applications of phosphoric acid; 8% potash produced a higher yield than 4%; and 4% nitrogen produced better yields than no nitrogen or 8% nitrogen. In comparing various amounts of the 4-10-4 mixture 1000 lbs. produced 3.7 bushels more than 2000 lbs. and 27.1 bushels more than 3000 lbs. He concluded that 1000 lbs. of a 4-10-4 resulted in the largest gross and the largest net profit. In this latter mixture the potash was derived from sulphate of potash and nitrogen from nitrate of soda. Ware also concluded that when nitrate of soda and muriate of potash was used the largest net profit was obtained when phosphorus was omitted.

Skinner, Williams and Mann (5) on Bladen fine sandy loam soil in North Carolina in a preliminary report on four years' test have found that increasing the amount of potash in a one ton per acre application of a mixture containing 6% phosphoric acid and 7% nitrogen, gave increasing yields up to 6%. As the amount of nitrogen in the mixture was increased up to 8%, the yield also increased but some of the differences were very small.

Amounts of 1600 lbs., 2000 lbs. and 2400 lbs., each of 5-7-5, 7-6-5 and 5-7-7 mixtures were compared and the results showed the 7-6-5 mixture to be the best and that an application of 2000 lbs., of the 7-6-5 mixture produced the highest yield. These workers also found that muriate returned better yields than sulfate or manure salts although the sulfate was tested only 3 years while the muriate and manure salts were tested four years.

Plan of the Experiment

The experiment of which this paper is a report was conducted at Clemson College on Congaree, a fine sandy loam soil. The same plots have been used each year. Previous to starting this experiment the usual farm crops were grown, generally oats and vetch in the winter or oats alone and corn or corn and cowpeas or soybeans in summer. During the first two years of the experiment, cowpeas were planted following the digging of the potatoes and plowed under in late fall (two years) or removed for hay (one year). Since then sweet corn or snap beans have usually followed potatoes but no fertilizer was applied to these crops.

The first three years there were only single plots of each treatment; since then duplicate plots. Each plot consisted of four rows one hundred feet long and three feet apart and were .2754 acre in area. Yield records were taken from the two inside rows. The fertilizer was mixed by hand thoroughly and the amount for each row weighed and applied separately, usually two to seven days before planting the seed pieces. Each row was plainly marked at 12″ intervals so that the same number of seed pieces were planted in each row and plot. Planting was done during the last week in March or the first week in April and digging occurred during the last few days in June or the first week in July. Digging was not started until the vines were dead. Usually one row was dug from each plot on the same day. Grading was done with a Boggs grader. In all operations all plots received uniform treatment except as to the kind and amount of fertilizer.

The Irish Cobbler variety was used, the seed being obtained from Maine. During the last six years certified seed was planted. The seed was treated for disease only two years during the test.

After obtaining the data on the actual yield the figures were corrected for stand and for soil variation and the figures given are in barrels per acre.

All applications were made at the rate of one ton per acre

except in one case where 1.5 tons were applied. The 5-7-5 treatment was used as the check. There were three plots between each two check plots. The sources of N were 60% nitrate of soda and 40% dried blood. Phosphorus from 16% superphosphate and Potassium from sulfate of potash the first 4 years and muriate of potash the last 5 years.

Table 1. Response of Irish Cobbler Potatoes to Various Kinds and Amounts of Fertilizers on Congaree Soil

TREATMENT	Total yield bbls. per A.	Increase over 5-7-5 bbls. per A.	Percentage No. 1's	Yield No. 1's bbls. per A.	Increase over 5-7-5 bbls. per A.
Phosphorus—					
5-5-5	68.3	- .6	77	53.1	- .4
5-7-5	68.9		77.7	53.5	
5-9-5	72.7	3.8	77.7	56.5	3.0
Nitrogen—					
5-7-5	68.9	-	77.7	53.5	
5-7-5+					
100 pounds soda	73.2	4.3	77.9	57	3.5
7-7-5	69.3	.4	77.6	53.8	.3
Potash—					
5-7-5	68.9	-	77.7	53.5	
5-7-5	70.	1.1	72.9	51.	- 2.5
5-7-9	69.9	1.0	74.8	52.3	- 1.2
Amount of Fertilizer—					
None	22.7	-48.2	55.9	12.7	-40.8
5-7-5 (1 ton)	68.9	-	77.7	53.5	
5-7-5 (1½ tons)	76.9	8.0	80.6	62.	8.5
Sources of Potash—					
Muriate	59.5		64.	38.1	
Sulfate	58.6		60.7	35.6	
Kainit	57.2		65.6	37.5	
None	48.6		59.6	29.	

The table shows that phosphorus in amounts of 5,7 and 9% make very little difference in yield. The 5-9-5 produced 3.8 bbls. more per acre than the 5-7-5, and 4.4 more barrels than the 5-5-5, the odds being 713. The percentages of No. 1's is practically the same and when figuring the yields in barrels of No. 1's per acre we find that the difference between the 5-9-5 and the 5-7-5 is only 3 barrels and between the 5-9-5 and 5-5-5 is but 3.4 barrels. Potatoes would have to bring a good price to be profitable to use 9% instead of 5% of phosphorus.

The 5-7-5 mixture plus 100 lbs. of nitrate of soda produced a higher total yield than 5% or 7% of nitrogen. None of these

differences, however, are significant. The percentages of No. 1's is almost exactly the same for the different percentages of N. The difference in yield of No. 1's per acre is also is favor of the 5-7-5 mixture plus 100 lbs. nitrate of soda, being 3.5 barrels more than the 5-7-5 mixture alone and 3.2 barrels more than the 7-7-5 mixture. Since none of these differences are significant 5% of nitrogen has given the most profitable yields.

Table 2—Comparison of Total Yields and Yields of No. 1's in Barrels per Acre.

Treatments A	Treatments B	Total Yields A	Total Yields B	Mean Difference A-B	Odds by Student's Method
5-9-5	5-5-5	72.7	68.3	4.4	713.0:1
5-9-5	5-7-5	72.7	68.9	3.8	14.6:1
1.5 Tons	1 Ton	76.9	68.9	8.0	89.1:1
5-7-5	5-7-5				
100 lbs. N. Soda	7-7-5	73.2	69.3	3.9	28.3:1
1.5 Tons	5-7-5				
5-7-5	100 lbs. N. Soda	76.9	73.2	3.7	14.6:1
5-7-7	5-7-5	70.0	68.9	1.1	6.24:1
	Yields of No. 1's				
1.5 Tons	5-7-5				
5-7-5	100 lbs. N. Soda	62.0	57.0	5.0	255:1
5-7-5	7-7-5	62.0	53.8	8.2	108:1
5-7-5	5-7-5	62.0	53.5	8.5	212:1
5-7-5	5-7-7	62.0	51.0	12.0	4999:1
5-7-5	5-7-9	62.0	52.3	9.7	999:1
5-7-5	5-5-5	62.0	53.1	8.9	36.5:1
5-7-5	5-9-5	62.0	56.5	5.5	17.9:1
7-7-5	5-7-7	53.5	51.0	2.5	36.5:1
5-7-5					
100 lbs. N. Soda	5-7-7	57.0	51.0	6.0	57.1:1
5-5-5	5-7-7	53.1	51.0	2.1	17.9:1
5-9-5	5-7-7	56.5	51.0	5.5	7.24:1

Note:—Comparisons between some treatments showed such small differences and the odds were so small that they are not shown.

In the case of potash smaller differences in yield resulted from the use of different percentages of the material in the fertilizer than was true of either phosphorus or nitrogen. Neither the differences in total yield nor in yield of No. 1's were significant, hence 5% was the most profitable application. The percentages of No. 1's for the 7% and 9% mixtures are the smallest in the whole experiment with the exception of the plots which had no

fertilizer. It is quite possible that 3% of potash would have been as satisfactory as 5%.

Differences in total yield resulting from the use of different amounts of fertilizer were greater than those obtained from any other part of the experiment. The 1.5 tons application produced 8 barrels more than the one ton application with odds of 89.1, and 54.2 barrels more than no fertilizer, which difference is, of course, also significant. The 1.5 tons application also shows the highest percentage of No. 1 potatoes. The yield of No. 1's obtained with 1.5 tons of 5-7-5 as compared with those from all the other treatments used in the experiment, shows a significant increase in favor of the former except in the case of the 5-9-5 (1 ton application) which gave a yield that was not significantly lower than that from the 1.5 tons of 5-7-5. The difference in barrels of No. 1's between the one ton and the 1.5 tons applications is 8.5 barrels. This is a rather small difference for an extra half ton of fertilizer and the No. 1's would have to bring over two dollars per barrel to make such a large application profitable.

As the experiment progressed the potatoes on the no fertilizer plot became increasingly late in appearing above ground. In 1931 the young plants appeared 7 days later than those on the fertilizer plots.

The experiment with sources of potash was made in the same soil as the previous test and from the small differences shown, it is evident that while applications of potash are necessary in this soil it does not make much difference in what form it is applied. In this test only single plots were used. Possibly with replicated plots greater differences would have appeared. The differences between the yield of No. 1's for the three sources of potash are also small.

The color of the foliage was a very dark green when potash was omitted from the mixture and a yellowish green on the kainit plots. On the muriate and sulfate plots the color was a lighter green than the no potash plot but darker green than the kainit plot.

Summary

In this experiment on Congaree soil 1 ton per acre of a 5-5-5 mixture gave the most profitable yield. Increasing the percentage of N, P or K in the mixture did not result in significant increases in yield except in the case of P where 9% gave a significant increase over 5% but not over 7%.

The application of 1.5 tons of a 5-7-5 mixture gave a significant increase over 1 ton application of the same mixture but

usually one ton of a complete mixture will return the most profitable yields. However, some years according to the cost of the fertilizer and to the price received for the potatoes a 1.5 tons application should be profitable.

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Potato Breeding

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The potato breeding project is carried on cooperatively with a number of state experiment stations. Formal agreements have been consummated with Minnesota, Iowa, North Dakota, Maine, Rhode Island, Michigan, New York (Cornell University), North Carolina and Louisiana.

Other states which are cooperating in a less extensive way are: Colorado, Maryland, Montana, New Jersey, Oregon, Tennessee, Wisconsin and Florida. In addition to these several other state experiment stations are testing the new variety Katahdin, which is being tested to determine its commercial possibilities in different regions.

The breeding work varies somewhat with the different stations but taken as a whole it includes the usual phases of any

well-organized breeding program. The methods used include:

Introductions,
Selection in commercial varieties,
Selection in inbred lines,
Crosses of inbred lines and other variations,
Crosses between inbred lines,
Varietal crosses,
Species hybrids.

In the fall of 1930 an exploration trip, sponsored by the Division of Foreign Plant Introduction of the U. S. Department of Agriculture was made in Mexico, to collect Solanum species. This trip is described by Dr. Reddick in the American Potato Journal, July 1931. Seventy samples of tubers and 28 samples of seed, representing several species were collected. Half of each sample collected was taken to Cornell University to be used in potato breeding work there; the other half was retained by the U. S. Department of Agriculture. Those from which tubers were collected were sprouted in the quarantine greenhouse in Washington. The sprouts after inspection were taken to Arlington Farm, potted, and later transplanted in the fields. Duplicates of these were grown at Aroostook Farm, also several others from seed. No tubers were set at either Arlington Farm or Presque Isle, except on a few numbers, some of which had the appearance of ***S. tuberosum.*** Seed was collected from 32 of these introductions. In addition to the introductions from Mexico, tubers of several crosses were received from Scotland, and seven varieties from Germany.

At the present time Dr. H. G. MacMillan of the Division of Horticultural Crops and Diseases and Dr. C. O. Erlanson of the Division of Foreign Plant Introduction are en route to South America to collect species of Solanum.

Systematic plant breeding, with the idea of combining the desirable characteristics of two or more parental varieties, necessitates the production of true seed. Under the conditions prevailing in certain of the cooperating states it is difficult, if not impossible, to obtain true seed. This would prevent the application of genetic principles to the breeding problems and so close one of the most promising avenues for their solution. Certain of the northern states are favored especially, since true seed of many strains and varieties, as well as tubers of good quality, free from disease, can be produced. In potato breeding, then, more perhaps than in any other breeding project, it is necessary that the interested states cooperate in their attacks on the many problems involved. At Presque Isle, Maine; Duluth and Castle Danger, Minnesota; Newland, North Carolina, and Estes Park, Colorado, the conditions are favor-

able nearly every season for the production of potato seed. Seed is, therefore, produced each year and distributed from Presque Isle, Maine, and from Minnesota, to a number of cooperating stations, where greenhouse and other facilities are available for growing and testing new seedlings. Last year seed of 13 crosses was distributed from Presque Isle. Colorado, Iowa, Michigan, North Carolina, North Dakota, and Oregon grew seedlings from several of these crosses.

Seed was distributed from Minnesota to North Dakota, Iowa, North Carolina, and Maine. In all the states combined approximately 40,000 seedlings were grown.

Another method is being employed to furnish some of the states with relatively large segregating progenies. This is done by means of single tuber distribution of the selections grown the first year from tubers at Presque Isle. Last year plants from these single tuber selections were grown in Iowa, Michigan, New York, North Carolina and North Dakota.

After a large number of seedlings have been discarded because of various defects, a few of the most promising ones are distributed in large lots for yield tests in the various states. Twenty-six new seedlings were distributed from Maine in 1931 for cooperative testing in Colorado, Iowa, Louisiana, Maryland, Michigan, Minnesota, Montana, New Jersey, New York, North Carolina, North Dakota, Rhode Island, Tennessee, and Wisconsin.

After a seedling has shown promise in these preliminary tests it is distributed in large lots to the states where it is tested cooperation with approved growers. This past year Katahdin, S. 42667, was grown in approximately 100 tests. Nearly three tons of this new variety were distributed to the states for these trials.

The reports from these tests indicate that it will take its place as a commercial variety in Maine, Michigan, Iowa, and in the western part of North Carolina. In several of the other states it will be tested again before definite conclusions are drawn.

It seems to be especially adapted to regions where the Rural types have been grown. It has the advantage over these in that it is highly resistant to mild mosaic, produces better shaped tubers with shallow eyes and a higher percentage of primes. It is not resistant to spindle tuber and as a result the present supply of seed stock is not free from it. It will be necessary to plant a number of seed plots on the tuber unit basis in 1932 and rogue carefully to obtain a supply of disease free seed

stock to distribute to growers. This work will be arranged for by the states which plan to distribute the variety.

Four new varieties produced in Minnesota have been given a rather extensive test in 1931. The results indicate that they are quite promising from the commercial standpoint for conditions in that state. The ideal potato has not, however, been obtained. • To find a potato with high yield, good shape, shallow eyes, resistance to many and sundry diseases of good cooking quality, is a large task.

Advances greater than those which might appear on the surface have already been made. Each of the cooperating stations are attacking different phases of the problems. At Aroostook Farm, Maine, some excellent breeding stock has been built up. The method used has been to select varieties or strains because of desirable characteristics and to continue these characteristics by crossing. A progeny test shows which combinations give the largest percentage of good types. Emphasis has been placed on obtaining high yielding varieties which produce good pollen, have good shape, shallow eyes, good cooking quality and resistance to disease.

Second Setting of Potato Tubers

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Potato tubers are borne on underground stems, commonly known as stolons which are modified branches arising from the nodes of the underground portion of the main stem. Stolon development under normal growth conditions starts early in the life of the plant. The stolons usually develop rapidly when the plant reaches a height of four to five inches.

Tuber formation is evident when there is localized swelling of these stolons. The setting of tubers with few exceptions is found at the ends of the stolons. Clark (1) states that "tuber formation begins in general at about the end of the period of flower bud development." He presented data to show that practically the entire crop of tubers was set at the beginning of the period of tuber development, probably within the space of a few days.

Under normal conditions of growth this is true in Ohio; but in abnormal years (especially during high temperatures such

as the year 1931), there may be a second or late development of stolons and tubers. This condition is quite common when the Rural varieties are grown in central and south-central Ohio.

This condition is found to be more prevalent on plants that have a light first setting. It was noted that only three tubers developed from the first setting. The summer heat was above normal. When cooler weather came in September, a new stolon growth began and a new setting of tubers. It was also noted that tuber development was not limited to the ends of the stolons, but that tubers were formed at many of the nodes along the stolons. Some of the tubers from this second setting were of fair size when the potatoes were dug; but being immature many rotted and those that did not rot, shrivelled rapidly.

Another case somewhat different from the one just given came to the writer's attention this past year. A forty-five acre field of Rural Russets was planted at the Dayton State Hospital at Dayton, Ohio, April 15. The writer was in this field July 15. Many plants were examined and no tubers were found that would measure ½ inch in diameter. Stolon development had taken place as well as tuber formation, but further tuber swelling had been retarded. The growth was about the same as that described by Bushnell (2) when plants were grown at 26 degrees Centigrade. This field was again visited in late August and plants examined; several tubers were found at this time that weighed from two to three ounces. Many of these tubers were found to be from a new setting and many of the first set had not developed further. The top growth in this field under normal growing conditions would indicate a 300 to 400 bushel yield but the field averaged about 125 bushels to the acre.

LITERATURE CITED

(1) **Clark, Charles F.** Development of Tubers in the Potato. U. S. D. A. Bul. 958, 1921.

(2) **Bushnell, John.** The Relation of Temperature to Growth and Respiration in the Potato Plant. Minn. Agri. Expt. Sta. Tech. Bul. 34, 1925.

Crop and Market News

Crop Prospects Reduced

(Contribution from the Bureau of Agricultural Economics)

A recent interesting development in the potato situation is a new association formed in the Stockton section of California, which claims a membership of 98% of the potato growers. Unlike most associations, it was not formed for the purpose of handling the sales, but represents more or less a gentleman's agreement to do and not to do certain things individually. To start with, each grower was required to deposit 50c per acre as an act of good faith. The principal objects of this association are to eliminate all No. 2 or small potatoes when a surplus exists; the regulation of harvesting, the selling and shipping to meet consumptive demands, the standardization of packs, and the elimination of destructive or unfair practices throughout the chain of distribution. This year the association plans to eliminate all No. 2 potatoes from marketing channels. They have agreed to neither sell nor transport for use any No. 2 potatoes, unless special permission is granted to do so. It is estimated this will reduce the California movement about 1,200 cars. Provision has been made, however, for charity distribution of the No. 2's through proper channels, such as the Red Cross or Community Chest, for the destitute or the unemployed. Revenues of the association will be secured by the sale of tags costing 1c each. This tag must be attached before the grower can sell or transfer a sack of potatoes. If any grower is caught shipping or selling potatoes without the consent of the association, he is fined 10c per sack. It appeared that efforts would be made to prevent the shipment this year of No. 2 Burbank potatoes from any of the far-western states.

Potatoes declined slightly during July, so that the August forecast was 367,000,000 bushels, or 9,000,000 less than last year. The decrease between July 1 and August 1 was due to hot, dry weather and was chiefly in western and central states.

The 18 surplus-producing late states, according to August estimates, expect 263,000,000 bushels, or slightly more than last season. The other late-potato states, which do not usually produce enough for their own needs, still have an estimated crop of 39,700,000 bushels, or 3,300,000 more than last year and

somewhat above average. Production in the seven intermediate states was reduced to 35,000,000 bushels.

In the following table are listed the late-shipping states which have an estimated crop of 10,000,000 or more bushels of potatoes either this year or last season:

States	1931 1,000 bu.	1932 1,000 bu.	States	1931 1,000 bu.	1932 1,000 bu.
Maine	50,960	47,850	North Dakota	8,436	12,160
New York	28,684	22,220	Nebraska	7,205	11,900
Pennsylvania	26,549	19,897	Idaho	24,200	21,285
Michigan	23,750	25,175	Colorado	9,595	16,240
Wisconsin	24,924	23,715	Ohio	11,220	10,440
Minnesota	28,880	31,620	30 Late States	298,219	302,771

The restricted market demand and the probable increase in motor-truck movement are both reflected in the light shipments during recent weeks. During the last week of July and the first three weeks of August, the average movement for each seven-day period was only about 1,700 cars, compared with 2,700 per week during the same period last year. Shipments during late August were coming chiefly from New Jersey, Long Island, Kentucky, Kansas, the North Central area, Nebraska and several western states. Total movement this season to August 20 was about 46,200 cars, as against 74,000 to the same time last year.

Prices have continued at a rather low level. Shippers of U. S. No. 1 Cobblers in New Jersey were receiving only 65c-70c per 100-lb. sack, and returns in the Kaw Valley of Kansas were around 55c. Early Ohios in the sandland district of Minnesota were bringing about 45c per sack on an f.o.b. basis. The Chicago carlot market during late August reported sales of Kansas Cobblers at 65c per 100 pounds, with receipts from Nebraska at 80c-85c and arrival from Wisconsin at 75c-80c. Minnesota Early Ohios averaged close to 75c per 100 pounds in Chicago, and Idaho Bliss Triumphs were considerably lower than they had been at $1.25-$1.35. Eastern jobbing markets quoted Cobblers from several eastern states within a range of 70c-$1.15 per 100 pounds. Some sales of barrels from Maryland and Virginia were still being made at $1.40-$2 in large distributing centers. With shipments becoming active in all of the late or main-crop states, the volume of carlot movement doubtless will increase and the effect upon the price is problematical.

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